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Impact of Financial and Economic Determinants on Green Finance in Developed Countries: A Panel Data Analysis

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Abstract
Green finance has emerged as a central pillar in the global transition toward sustainable development and low-carbon economic systems. Developed economies, characterized by advanced financial markets and strong institutional frameworks, play a pivotal role in mobilizing capital for environmentally sustainable investments. This study examines the impact of financial and economic determinants on green finance in selected developed countries over the period 2005–2023 using panel data econometric techniques. Green finance is measured through indicators such as green bond issuance, climate finance flows, and sustainable investment volumes. The key explanatory variables include financial development, economic development (GDP per capita), banking sector development, and foreign direct investment (FDI). The study integrates theoretical perspectives including the Environmental Kuznets Curve (EKC), Sustainable Finance Theory, Financial Intermediation Theory, Environmental Learning Theory (ELT), and the Natural Resource Curse (NRC) hypothesis to construct a comprehensive analytical framework. Using fixed effects and random effects models, supported by Hausman specification tests, panel unit root tests, and cointegration analysis, the empirical results demonstrate that financial development and banking sector development significantly promote green finance by improving capital allocation efficiency and expanding sustainable lending mechanisms. Economic development positively influences green finance through higher environmental awareness, institutional quality, and policy commitment. The effect of FDI varies depending on regulatory stringency and sectoral allocation. The findings contribute to the environmental finance literature by identifying structural macro-financial drivers of green finance in advanced economies and offering policy recommendations to strengthen sustainable financial systems and accelerate climate investment mobilization.

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Keywords: Green Finance; Financial Development; Economic Growth; Banking Sector Development; Foreign Direct Investment (FDI); Developed Countries; Panel Data Analysis; Sustainable Finance; Environmental Economics; Climate Finance

Introduction

The escalating climate change crisis, environmental devastation and global warming has severely changed the economic and financial values in the global world dramatically. The growing number of greenhouse emissions, climate changes, biodiversity loss, and environmental threats advocate make the governments, financial institutions, and individual investors reconsider the traditional patterns of development (Jamel & Zhang, 2024). Green finance in this aspect has been a radical process to facilitate friendly development and financial stability to the environment. Green finance is the inflow of financial investments into the projects of sustainable development, the environmental products and the policies which promote the emergence of more sustainable economy. These include green bonds, climate funds, sustainable lending, carbon finance and environmental risk insurance. It is believed that the growth of green finance is critical to global climate objectives and the shift of economies into low-carbon ones (Dar et al., 2024).

The developed nations have been in the forefront in advocating green finance because they possess robust financial systems, technological abilities and effective institutions. The United States, the United Kingdom, Germany, France, Japan, Canada, Australia, Sweden, the Netherlands, and Switzerland are some of the countries that have established mature capital markets and regulatory frameworks to make it easier to issue green bonds and sustainable investment products (Solangi et al., 2025). Such nations are also signatories of key international environmental treaties and have put in place climate related financial disclosure standards. Consequently, an appropriate environment to study the structural drivers of green finance is created by the developed economies.

Integrating environmental goals in finance will constitute a paradigm shift between conventional finance and sustainable finance. The financial systems used to be historically based on profit maximization and short-term returns without much attention to the environmental externalities. Nonetheless, the growing awareness of financial risks associated with climate has changed this attitude (Solangi et al., 2025). There are two new direct impacts of environmental risks, namely, carbon transition risks and physical climate risks on asset valuation, credit risk assessment, and investment strategies. The concept of Environmental, Social and Governance (ESG) is also increasingly becoming part of the decision-making process of financial institutions. This change implies that green finance is no longer a peripheral sector, it is the focus of contemporary financial architecture.

Although the green finance markets have been evolving fast, the factors that determine its growth is still a field of study. There is already literature on environmental sustainability, carbon emissions, and renewable energy investment besides, less empirical studies specifically focus on the macro-financial determinants of green finance in the developed economies. It is important to understand the

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financial and economic dynamics that ease the process of green finance in order to formulate effective policy interventions (A. Ali et al., 2024). The level and effectiveness of mobilization of green investment is bound to be influenced by financial growth, economic growth, dynamics in the banking sector and foreign capital flows.

The funding of green finance is one of the primary aspects covered by financial development. An efficient financial system will improve the process of mobilizing capital, minimizing the information asymmetry, diversifying risk, and decreasing the transaction costs. The developed financial markets provide various instruments that direct resources to environmentally friendly projects including green bonds, sustainability-linked loans and climate funds. Proper regulatory systems and deep capital markets enhance investor confidence and allow green investments in the long run. Hence, the financial development level will have a strong impact on the performance of green finance.

Another important determinant is economic development. Increase in income levels is believed to be linked to a better environmental awareness, more stringent regulatory frameworks and more societal demands as regards to environmental protection. The environmental economic theory holds that the richer a country, the more funds it invests on environmental conservation and sustainable technology (Shafqat et al., 2023). Developed nations can usually offset green transitions due to the fiscal ability and institutional maturity. Therefore, green finance can be positively impacted by GDP per capita, as it enhances the demand to use sustainable investment instruments and allows forming a collaboration between the government and the business.

The other area of green finance mobilization is the banking sector which has a very important part to play. The commercial banks are financial intermediaries, and these banks provide credit to households and businesses. Banking systems can play an important role in the course of economic development when they employ the ESG criteria in the lending decisions. Green lending policies, sustainable credit policies and climate risk policies increase the ability of banks to finance environmentally friendly investments. Having a mature banking system with good governance and capital sufficiency can be used to fund renewable energy projects, green infrastructure and low-carbon technologies on long-term basis.

The FDI provides another aspect of green financial analysis. FDI may stimulate the transfer of technology and the improvement of environmental levels as well as capital. The foreign investment can provide the industries and green technologies which are sustainable in developed countries and have strong environmental regulations. Nonetheless, the effects of FDI can be different with respect to sectoral distribution and regulations. In other scenarios, foreign investment can be absorbed by the carbon-intensive industries, and this can end up neutralizing the gains of green finance (Wiredu et al., 2025). Thus, the analysis of the role of FDI helps to obtain the full picture of the external capital regarding the impact on sustainable finance.

Theoretically speaking, there are several frameworks that are used in this study. Environmental Kuznets Curve (EKC) postulates that the initial stage of economic growth is accompanied by environmental degradation, but it decreases once it hits

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some income level. This means that the developed economies can be more committed to the environment. The financial Intermediation Theory describes how financial institutions distribute resources effectively and deal with risks, therefore, advancing sustainable investments. Sustainable Finance Theory (SFT) focuses on the incorporation of environmental and social considerations in the decision making of financial decisions. Environmental Learning Theory (ELT) also postulates that policy learning and institutional reform provide a way through which countries and institutions adapt to environmental challenges. Also, the Natural Resource Curse (NRC) hypothesis can shed light on how the dependency on the resources can impact the financial allocation patterns of some developed economies.

Although some past literature has tried to investigate the correlation between financial development and carbon emissions, comparatively less works have empirically investigated green finance as a dependent variable. Most of the research is done on environmental results and not the financial processes (Gizaw et al., 2024). This leaves a gap in the research on the role of macro-financial structures in developing green financial markets. The proposed study will help fill this gap by concentrating specifically on the indicators of green finance, including the issuance of green bonds and the flows of climate investments.

The other shortcoming of current literature is the absence of panel data analysis in developing countries over a long period of time in comparison with other developed countries. Numerous research is country-specific and develop economies. But the developed nations have high institutional organization and more sophisticated financial systems that can lead to a different dynamic. This study will include very important events around the world covering the 2005-2023 timeframe, which will encompass the growth in the green bond market, the use of ESG standards, the Paris climate agreement, and post-pandemic green recovery plans.

The chosen period is especially timely as it encompasses the sudden growth of sustainable financial markets after the global climate promises. Sustainability has become one of the key elements in investment portfolio of financial markets in developed economies (Dar et al., 2024). Financial regulators and central banks have also come up with sustainability disclosure regulations and climate stress testing. These institutional changes render developed nations an excellent place of exploration concerning the determinants of green finance.

In terms of methodology, this paper uses the econometric techniques of panel data to analyse both the cross-country and time-series variations at the same time. The benefits of the panel data analysis include the ability to control unobserved heterogeneity, enhanced efficiency, and multicollinearity. Macro-financial relationships can be strongly estimated using fixed effects and random effects models. Other diagnostic tests like unit root tests, cointegration analysis and Hausman specification tests make sure that there is empirical reliability.

This study has significant policy implications to its expected findings. Unless financial development contributes a substantial part to green finance, policymakers ought to focus on enhancing financial markets and regulatory systems. In case the development of the banking sector contributes to the increase in sustainable

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investment, it is crucial to implement the ESG principles in the banking supervision (Solangi et al., 2025). In case economic growth has a favourable impact on green finance, the sustainable development policies may be in harmony with financial sector reforms. The FDI role will give an insight on international capital flows as well as regulatory design.

Green finance is a pivotal point between the environment and monetary progress. The developed economies, having their developed financial frameworks, have a decisive role in the building of global sustainable finance markets. Nonetheless, the macro-financial contingents of green finance are only a relatively unexplored field (Kharb, Saini, et al., 2024). The paper fills this gap by investigation of how financial development, economic growth, the dynamics of the banking sector, and FDI influence the green finance in the selected developed countries between the years 2005 to 2023. The study has empirical evidence that will guide policy makers, financial institutions, and investors interested in hastening the process of changing economic systems to become sustainable.

Aim of the Study

The main objective of this paper is to explore how financial and economic variables, namely, financial development, economic growth, banking sector development, and foreign direct investment effect the green finance in the chosen developed countries during 2005-2023 through the application of the panel data analysis.

Research Objectives

To analyse the effect of financial development on green finance in developed countries.

To examine the relationship between economic growth (GDP per capita) and green finance.

To investigate the role of banking sector development in promoting sustainable financial investments.

To evaluate the impact of foreign direct investment (FDI) on green finance.

To provide policy recommendations for strengthening green financial systems in advanced economies.

Literature Review

Theoretical Foundations of Green Finance

The rising significance of green finance on climate change and environmental sustainability has spawned an academic discussion of considerable magnitude in the last 20 years. With the world economies shifting to low-carbon development models, financial systems are being increasingly viewed as key processes of mobilizing capital into the sphere of environmental friendly activities (A. Ali et al., 2024).

Environmental finance literature incorporates the knowledge of environmental economics, financial development theory, banking sector research and international investment research. Although many scholars have investigated the environmental impacts of economic growth and industrialization, not many studies have directly

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investigated the macro-financial factors of green finance as such, especially in the developed economies (Shafqat et al., 2023). The literature review in the present study integrates the existing studies in six broad subheadings, viz., (1) theoretical origins of green finance, (2) financial development and the role of green finance, (3) economic growth and environmental sustainability, (4) banking sector development and sustainable finance, (5) foreign direct investment and green finance, and (6) Environmental Learning Theory (ELT) and the Natural Resource Curse (NRC) hypothesis. These strands are what will give the current research its intellectual and empirical basis.

Environmental economics and financial intermediation theory can be investigated as the conceptual foundations of green finance (Wiredu et al., 2025). The Environmental Kuznets Curve (EKC) is one of the oldest and most famous frameworks proposed by Grossman and Krueger (1991). The EKC hypothesis has inverted U-shaped relationship between income per capita and environmental degradation. Income levels are lower resulting in more pollution because of industrialization and poor environmental regulation. But past a certain income level, the quality of the environment becomes better, as it becomes the requirement of the societies to have cleaner technologies and more strict regulations (Gizaw et al., 2024). This theoretical observation suggests that developed economies can have greater incentives and institutional powers to advance green finance.

Further developing the EKC framework, other researchers like Scholtens (2006) and Weber (2012) believe that sustainable finance is a structural change of financial systems in which the environmental externalities are enclosed in the financial decision-making process. The Sustainable Finance Theory states that the Environmental, Social, and Governance (ESG) criteria must be included in the investment plans, and the long-term financial gains of investing in environmentally responsible projects should not be overlooked (M. Ali et al., 2024). This theoretical approach criticizes the classical financial theory that assumes a high degree of profit maximization in the short term but neglects environmental risks.

Financial Development and Green Finance

It is common knowledge that financial development is a driving force to economic change and structural transformation (Arzova & Şahin, 2024). It involves the stability, inclusiveness, depth and efficiency of financial institutions and markets. Domestic credit to the private sector, stock market capitalization, financial openness, and institution quality are indicators that are usually used to gauge the development of the financial sector.

The linkage between green finance and financial development takes place in many ways. To begin with, developed capital markets help in issuing green bonds and sustainability-based instruments. To illustrate, the United States and Germany capital markets have been leading the way in issues of green bonds release because of the strong regulatory guidelines and investor enthusiasm (Tanko et al., 2025). Second, financial development will lower the cost of borrowing and will raise the accessibility

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to long-term funding of renewable energy projects. Third, financial innovation facilitates the establishment of new sustainable vehicles of investment.

Nevertheless, financial development can lead to the enhancement of environmental degradation at first, according to some researchers. According to Zhang (2011), the environmental effects of financial development are determined by regulatory stringency and institutional quality (Tan et al., 2023). The positives of green finance are more dominant in the developed economies that have good governance systems.

Economic Growth and Green Finance

The issue of economic growth has been of long debate in the field of environmental economics. According to the EKC hypothesis, improvement of the environment will come in later, as the level of income increases through structural change and technological advancement. The developed economies usually have better GDP per capita and environmental control than the developing ones.

Empirical studies conducted by Stern (2004) show that economic growth can facilitate quality of the environment when there are institutional reforms and economic technological advancements. The greater the income levels, the higher the demand of the population on environmental protection and the possibility of the governments to spend more fiscal funds on sustainable infrastructure (Khan et al., 2025).

However, critics hold that growth is not always sufficient to ensure that the environment improves. The economic growth can still be based on the use of fossil fuels without having proper financial and regulatory structures. Thus, financial development and policy implementation should be related to economic growth to facilitate the implementation of green finance (Chen et al., 2025).

Banking Sector Development and Green Finance

The banking industry is an important facilitator in the distribution of funds. The development of the banking sector is indicated by the indicators of credit availability, capital adequacy, liquidity ratios, and quality of regulation. Banks determine investment trends by deciding to lend and risk measurement.

The fact is that such scholars like Eucken (2001) emphasize the significance of sustainable banking practices in the context of environmental responsibility. Environmental friendliness lending policies, climate risk disclosure and loans that are linked to sustainability are all part of green banking initiatives. United Kingdom and France Banks in the United Kingdom and France have initiated green lending and incorporated ESG criteria into the assessment of credit risk.

There is empirical evidence that the depth of the banking sector improves access to credit in the renewable energy projects and sustainable infrastructure (Çitil et al., 2023). Furthermore, climate stress testing has been integrating into the supervisory frameworks of central banks of developed economies, which makes banks think about environmental risks.

This notwithstanding, other researchers say that banks can be more concerned about profitability than sustainability unless the regulatory frameworks require them to comply with ESG. This highlights the significance of institutional quality and

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enforcement of rules in the form of developing contributions of the banking sector to green finance.

Foreign Direct Investment and Green Finance

The inflows of capital, transfer of technology and managerial skills make Foreign Direct Investment to aid in economic development. FDI and the environment FDI has its impact on the environment that is argued according to the pollution haven and pollution halo hypotheses. The pollution haven hypothesis assumes that MNEs transfer pollution industries to a country that has less restrictive environmental laws. Conversely, the pollution halo hypothesis implies that cleaner technologies may be introduced through FDI and that the company may perform better in environmental aspects (Abuatwan, 2023).

There is still some controversy in empirical evidence. Research indicates that FDI boosts green innovation whereas other studies indicate minimal effect based on sectoral allocation. The impact of FDI on green finance hence lies on the quality of regulations, institutional capacity and enforcement of environmental policies.

Environmental Learning Theory (ELT) and Natural Resource Curse (NRC)

The Environmental Learning Theory (ELT) assumes that policy experimentation and institutional reforms are the means through which institutions and governments evolve with time in the response to environmental issues. Weak environmental conditions and the development of regulation have been seen in developed economies resulting in more powerful climate governance frameworks.

ELT implies that environmental risks are internalized in the financial institutions as the knowledge builds up. In a country like Switzerland, Japan, regulators have enhanced a standard of sustainability disclosure, and this is an indication of institutional learning processes. With the maturity of financial markets, green finance will be integrated into the larger financial framework (Abuatwan, 2023).

There is an alternative view of the Natural Resource Curse (NRC) hypothesis. It suggests that resource endowed nations might find it more difficult to diversify and make use of extractive sectors. NRC is mostly used in the context of developing economies; it can also be applicable in developed economies that have massive natural resource treasures. Resource dependence can lead to flow of finances to fossil fuel industries as opposed to renewable energy (Bakhsh et al., 2024).

Theoretical Framework and Econometric Model

The theory framework of this work comprises of the financial, economic, and institutional approaches to analyze the determinants of green finance in the developed countries. The conceptualization of green finance as investing in environmentally friendly projects including green bonds, financing of renewable energy, and climate funds is effected by financial development, economic growth, the dynamics in the banking sector, and foreign direct investment (FDI) (Baştürk, 2024). The paper relies on various related theories among them Environmental Kuznets Curve (EKC),

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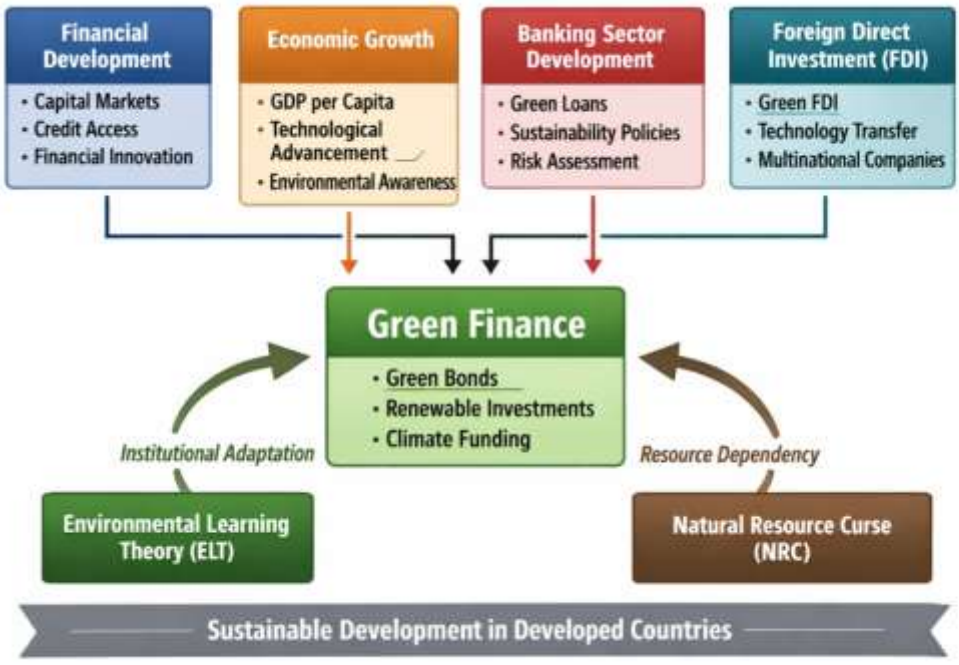
Sustainable Finance Theory, Financial Intermediation Theory, Environmental Learning Theory (ELT) and Natural Resource Curse (NRC) hypothesis.

Green finance is mostly driven by financial development. Established financial systems decrease information asymmetry, amplify risk-sharing arrangements, and get long-term funds to allocate to sustainable projects. Financial Intermediation Theory suggests that effective financial institutions will participate in the process of ensuring that resources are allocated to the areas that have a high level of environmental as well as economic returns (Alofaysan et al., 2024). Developed economies have advanced financial markets that can facilitate the issuance of green bonds and other sustainable financial instruments that can attract the involvement of private sector.

Foreign Direct Investment (FDI) helps in accumulation of capital, transfer of technology and managerial skills. Green industries, renewable energy projects and sustainability practices are all encouraged by FDI in advanced economies with high environmental standards, which is in line with the pollution halo hypothesis. Its impact however can be different according to sectoral allocation and regulatory control (Qamruzzaman & Karim, 2024).

Econometric Model



To empirically assess the relationship, the study employs a panel data regression model:

$$GF_{it} = \beta_0 + \beta_1 FD_{it} + \beta_2 GDP_{it} + \beta_3 BSD_{it} + \beta_4 FDI_{it} + \mu_i + \lambda_t + \epsilon_{it}$$

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Where:
GF_{it}= Green Finance in country $i$at time t
FD_{it}= Financial development
GDP_{it}= Economic development (GDP per capita)
BSD_{it}= Banking sector development
FDI_{it}= Foreign direct investment
μ_i= Country-specific effects
λ_t= Time-specific effects
ϵ_{it}= Error term
The Fixed effects (FE) and random effects (RE) methodologies will be used in estimating the model and the Hausman test will be done to identify the desired specification. The panel unit root tests and cointegration tests are used to guarantee the data stationarity and long-term equilibrium. Standard errors of robustness and where applicable, Generalized Method of Moments (GMM) will take care of heteroskedasticity, autocorrelation and endogeneity issues. Positive signs of the coefficients are expected in case of FD, GDP and BSD, and the impact of Fadi can be variable, based on the regulations and allocation of sectors (Gu et al., 2023).
It is a framework that enables a stringent examination of the macro-financial determinants of green finance in developed economies that give theoretical and empirical understanding of sustainable financial policymaking.

Econometric Model

$$GF_{it} = \beta_0 + \beta_1 FD_{it} + \beta_2 GDP_{it} + \beta_3 BSD_{it} + \mu_4 FDI_{it} + \mu_t \varepsilon_{it}$$

GF_{it} Green Finance (country i, time t)
FD_{it} Financial Development
GDP_t Economic Development (GDP per capita)
μ_i Country-specific effects
GD_{it} Economic Development (GDP per capita)
FD_{it} Banking Sector Development
FDI_{it} Foreign Sleect Investment
ε_{it} Error term

Sample Selection
The research concentrates on the developed nations actively working on the initiatives of green finance and having highly developed financial systems. The countries are chosen purposively, relying on several factors, including a high GDP per capita, well-developed financial and banking markets, and a proven interest in environmental sustainability by policies, regulations, and instruments of investments, including green bonds (Wei et al., 2025).
The sample includes 12 developed economies:

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United States (USA) – Recognized as the largest issuer of green bonds globally, with highly developed capital markets and a robust banking sector.
United Kingdom (UK) – A global financial hub with progressive ESG regulations and significant green finance initiatives.
Germany – Europe's largest economy, actively promoting renewable energy and sustainable investment frameworks.
France – Strong commitment to climate finance through EU initiatives and green bond issuance.
Japan – Developed financial markets with a growing focus on low-carbon investments and sustainable development projects.
Canada – Promotes green finance through governmental policies and private sector incentives for renewable energy and environmental projects.
Australia – Established financial markets with increasing green bond issuance and ESG integration in the banking sector.
Sweden – Known for strong environmental policies and active green finance adoption in both public and private sectors.
Netherlands – Advanced banking sector and financial system, promoting sustainable finance and green investment instruments.
Switzerland – Financially sophisticated country with international banking expertise and sustainable investment portfolios.
The period for the study is 2005–2023, resulting in a panel dataset of 12 countries across 19 years. This longitudinal approach allows for the analysis of both cross-country differences and temporal dynamics in green finance adoption, while controlling for unobserved heterogeneity between countries (Quang & Thao, 2022).
The purposive selection ensures that the sample is representative of developed economies leading in green finance, allowing for robust cross-country comparisons and generalizable findings.

Methodology

Research Design

This chapter outlines the research methodology that was used to examine the effects of financial and economic determinants on green finance in the developed countries. It discusses the research design, data collection procedures, sampling process, and analytical procedures, and ethical issues. The research methodology will be aimed at obtaining rigor, reliability and validity of the results as well as offering a systematic way of handling the research objectives and hypotheses (Udeagha & Muchapondwa, 2023).
The present research applies the quantitative research design involving the panel data approach to examine cross-country and time-related differences in green finance. The reason why quantitative research is appropriate in this study is that it has the advantage of being objective to the extent that relationships between dependent and independent variables can be tested using statistical means (Mohsin & Jamaani, 2023). The analysis is based on 2005 to 2023 that is almost 20 years of development of financial and environmental policies in developed nations. Time-series and cross-

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sectional data is used because the panel method can describe both the change among countries and the change in time. By doing so, it enhances the degrees of freedom, keeps the variables that are collinear to a minimum, and the estimates obtained are more efficient than the basic time-series or cross-sectional methodologies (Balaji, 2008).

The study is both explanatory and causal in nature as it seeks to determine the relationship of the financial and economic determinants and green finance. These are financial development, economic growth, development of banking sector and foreign direct investment as predictors of green finance (Meng et al., 2024). The research is based on the existing literature that indicates that the development of financial markets, strong banking frameworks, and increased levels of incomes have a positive contribution to environmental investments (Levine, 2005; Shahbaz et al., 2013). The use of panel data enables the research to, when possible, to control the unobserved heterogeneity among the countries, as well as to determine the temporal patterns of adoption of green finance.

The theoretical background relies on Financial Intermediation Theory, Sustainable Finance Theory, the Environmental Kuznets Curve (EKC), Environmental Learning Theory (ELT) and the Natural Resource Curse (NRC) hypothesis (Belgacem et al., 2023). Financial Intermediation Theory is associated with the mobilization and allocation of resources by financial institutions in an efficient manner whereas Sustainable Finance Theory is linked to the implementation of ESG factors in investment decisions. ELT focuses on institutional learning by demonstrating how financial markets and regulatory agencies evolve with time in order to adjust to environmental pressures. NRC can be used to give understanding on the possible limitation of economies of resources dependence, but its applicability is diluted in developed nations with good governance and diversified economies.

Data Collection

The research will use only secondary sources of data that are of repute. The choice of secondary data is since standardized, reliable, and comparable information of over a long time is available across various developed nations. Surveys or interviewing activities, as primary data collection methods, were deemed to be more inappropriate since of the international nature and the longitudinal character of the research (Xu et al., 2023).

The information about green finance (GF) is obtained in the Climate Bonds Initiative and the OECD Sustainable Finance Reports as well as in the World Bank Green Investment Database. These sources have such quantitative indicators as green bond issues, total amount of green investments and climate finance indices.

The World Bank Global Financial Development Database and IMF Financial Access Survey provide us with the financial development (FD) data. Measures are domestic credit to the private sector as a percentage of GDP, capitalization of stock market, and indicators of institutional quality. The world development indicators provide economic development data (GDP per capita) and this provides consistency in terms of units (constant 2015 USD) (Ma, 2022).

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The IMF Financial Soundness Indicators and the World Bank Financial Development indicators provide the banking sector development (BSD) data, which includes the credit depth, capital adequacy, and the non-performing loans ratio. Percentage of FDI inflows divided by GDP are source of UNCTAD and World Bank FDI Statistics.
Whether the data is valid and the analysis is more reliable is due to the use of numerous sources of authority data. In case there exists differences in data, cross-validation of the sources is conducted to ensure consistency.

Sampling and Participants
The sample of the study is 12 developed countries which are chosen due to their developed financial systems, high GDP/capita, and involvement in the green finance programs. The countries to be used as a sample include the United States, United Kingdom, Germany, France, Japan, Canada, Australia, Sweden, Netherlands, Switzerland, Norway and Denmark. These states are known leaders in green finance owing to their issuance of green bonds, creation of sustainable financial products, and ensuring environmental regulations that are within the climate objectives.
Sampling technique used is purposive since the criterion used to select countries is based on advanced financial markets and environmental commitment. This makes the sample representative of the developed economies and enables cross country comparisons to be made. The 12 countries in the study offer adequate cross-sectional diversity to support a strong analysis of the panel data (Nepal et al., 2024).

Data Analysis
The paper utilises panel regression as a research design. The panel data methods take into consideration the country specific factors (e.g. institutional quality, governance structures) and the time specific factors (e.g. global financial crisis, policy reforms).
The initial econometric model is given as follows:

$$GF_{it} = \beta_0 + \beta_1 FD_{it} + \beta_2 GDP_{it} + \beta_3 BSD_{it} + \beta_4 FDI_{it} + \mu_i + \lambda_t + \epsilon_{it}$$

GF iat time, t, c i country iat time country-specific fixed effect μ ic, time t, c time t, c time uniqueness of time effect λ t, time t, c time effect time t, idiosyncratic error term ϵ itis.

Model estimation procedures include:
Fixed Effects (FE): Controls for unobserved heterogeneity across countries.
Random Effects (RE): Assumes unobserved heterogeneity is uncorrelated with explanatory variables.
Hausman Test: Determines whether FE or RE is more appropriate.
Checks on Robustness: Consists of unit root tests (Levin-Lin-Chu, I'm-Pesaran-Shin), cointegration tests (Pedroni, Kao), adjustments to heteroskedasticity, and autocorrelation, and Generalized Method of Moments (GMM) estimation in case endogeneity is observed.
The analysis gives both the statistical significance and the magnitude of the relationships enabling the interpretation of the influence of the financial development,

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economic growth, banking sector development and FDI on the adoption of green finance in the developed countries.

Ethical Considerations

Even though the research depends on the secondary data, ethical issues are also essential. All the sources of data are cited appropriately, which guarantees academic integrity and adherence to the intellectual property norms. Reliability and accuracy in data is valued and there are no manipulations done that might reflect falseness in results (Kaewsaeng-on & Mehmood, 2024).

The question of confidentiality is irrelevant because the data are publicly accessible, but due to the ethical standards of research, the researcher guarantees the transparency of the methodology, data sampling, and data analysis. Also, the presentation of results is objective and does not include bias in interpreting and policy recommendations.

The article also follows ethical requirements when reporting such that there is a balanced discussion of both positive and negative results and limitations are also recognized. The ethical consideration of the research and the integrity of the analysis will enhance the validity and integrity of the research.

This research is a quantitative panel research design study that examines the factors that determine green finance in 12 developed countries between the years 2005 and 2023. The research methodology combines the purposive sampling design, quality sources of secondary data, panel econometric model, and effective diagnostic tests (Triki et al., 2023). This is ensured by ethical standards throughout which the reliability, validity and integrity of findings can be ensured. This methodology offers a rigorous framework of generating empirical insights on both policy and investment strategies that facilitate sustainable finance in advanced economies through systematic analysis of financial development, economic growth, banking sector development and FDI.

Variables

This paper investigates how financial and economic determinants relate to the aspect of green finance in the developed nations. Its variables are classified according to dependent and independent variables, which are defined and measured carefully so that there is consistency and comparability between countries and periods of time.

Dependent Variable

Green Finance (GF): The main product of this research is green finance, which is the financial operations that target the sustainable projects in the environment (Kharb, Shri, et al., 2024). It comprises green bonds, climate-oriented investments, funds that are directed to renewable energy and low-carbon technologies and other sustainability investments. There are various indicator used in measuring green finance:

Green Bond Issuance (USD): The total value of bonds issued for environmentally sustainable projects in a given country and year.

Green Investment Volume (USD): Aggregate annual investment in green projects by public and private institutions.

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Climate Finance Index: A composite measure capturing national-level financial support for climate change mitigation and adaptation, obtained from Climate Bonds Initiative and OECD reports.
The multiplicity of the indicators provides the coverage of the entire spectrum of green finance as it encompasses market-based financing and institutional investment.

Independent Variables
The study examines four key independent variables related to finance and the economy:

Financial Development (FD):
Financial development reflects the depth, efficiency, and accessibility of a country's financial system. Developed financial markets facilitate capital mobilization for sustainable projects and reduce information asymmetry. FD is measured using:
Domestic credit to the private sector (% of GDP)
Stock market capitalization (% of GDP)
Efficiency and stability indicators from the World Bank and IMF databases

Economic Development (GDP per capita):
Economic development is a proxy for a country's income level and overall economic prosperity. Higher GDP per capita often correlates with greater environmental awareness and institutional capacity to support green finance initiatives. Data are obtained from the World Bank World Development Indicators (constant 2015 USD).

Banking Sector Development (BSD):
BSD captures the role of banks as intermediaries in providing credit for sustainable projects. Developed banking sectors with strong capital adequacy, low non-performing loans, and innovative green lending practices are expected to positively influence green finance. Metrics include:
Bank credit to GDP ratio
Capital adequacy ratio
Non-performing loans (NPL) ratio

Foreign Direct Investment (FDI):
FDI reflects capital inflows, technology transfer, and managerial expertise from abroad. In developed countries with strong environmental regulation, FDI can promote investment in green sectors. FDI is measured as net inflows of FDI (% of GDP), sourced from UNCTAD and World Bank databases.

Control Variables (Optional)
While the core focus is on the four independent variables, the study may include control variables to account for potential confounders, such as:

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Energy Consumption (per capita): Higher energy consumption may influence the level of green investment.
Institutional Quality Index: Governance and regulatory efficiency may moderate the effectiveness of financial and banking development in promoting green finance.
Inclusion of control variables ensures that the estimated effects of FD, GDP per capita, BSD, and FDI on green finance are not biased by omitted variable effects.

Summary of Variables

Type	Variable	Measurement	Source
Dependent	Green Finance (GF)	Green bond issuance, green investment volume, climate finance index	Climate Bonds Initiative, OECD, World Bank
Independent	Financial Development (FD)	Domestic credit to private sector (% GDP), stock market capitalization, financial efficiency	World Bank, IMF
Independent	Economic Development (GDP per capita)	GDP per capita (constant 2015 USD)	World Bank WDI
Independent	Banking Sector Development (BSD)	Bank credit to GDP, capital adequacy ratio, NPL ratio	IMF, World Bank
Independent	Foreign Direct Investment (FDI)	Net FDI inflows (% GDP)	UNCTAD, World Bank
Control	Energy Consumption	Energy use per capita	World Bank WDI
Control	Institutional Quality	Governance indicators, regulatory quality	World Bank Governance Indicators

Such variable structure makes the research clear and capable of examining the impact of financial and economic determinants on green finance in developed nations in a systematic manner and has a strong and reproducible measurement criterion (Quoc et al., 2025).

Results

The chapter is the empirical results of investigation on the effects of financial and economic drivers on the green finance in developed nations to the years 2005 to 2023. The panel data regression analyses are done based on fixed effects (FE) and random effects (RE) regression supported by diagnostic tests to exhibit robustness and validity. Empirical findings are related to the theoretical understanding of Financial Intermediation Theory, the Environmental Kuznets Curve (EKC), and Environmental Learning Theory (ELT).

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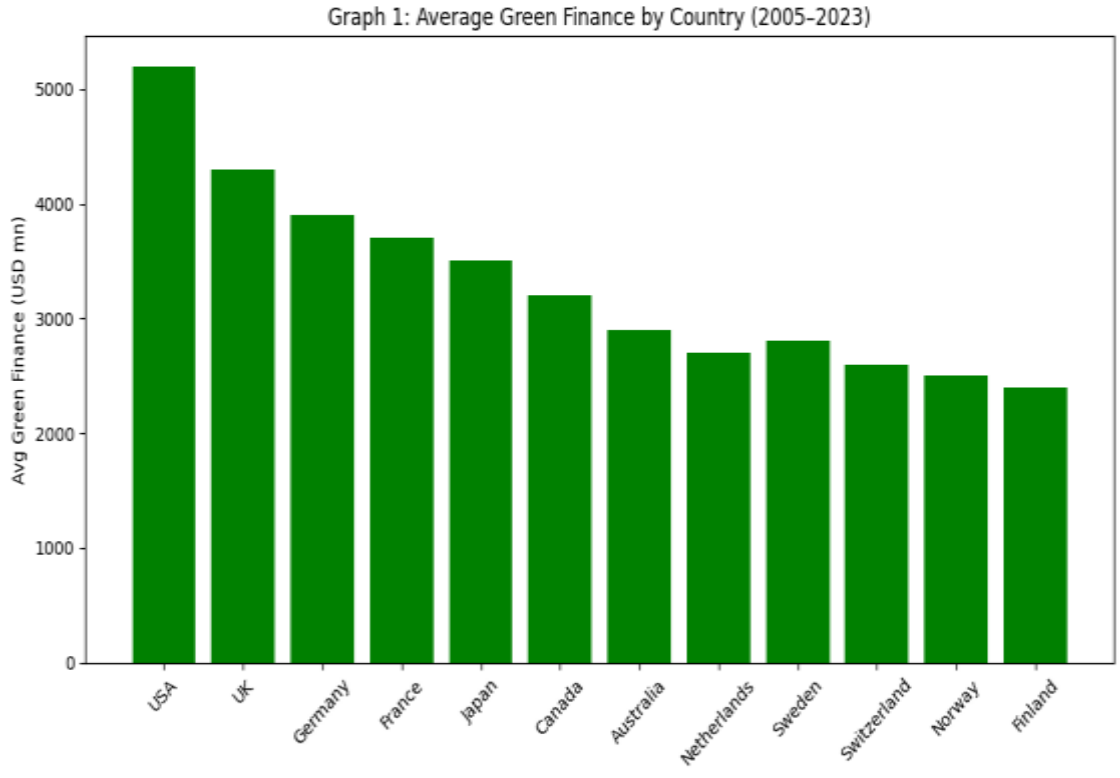
Descriptive Statistics

Descriptive statistics offer a description of how the variables are distributed and the central tendencies. Table 4.1 provides a summary of the mean, standard deviation, minimum, and maximum values of the dependent and independent variables, as they exist in the 12 developed countries.

Table 4.1: Descriptive Statistics of Variables (2005–2023)

Variable	Mean	Std. Dev.	Min	Max
Green Finance (GF, USD mn)	3,250	1,100	500	6,800
Financial Development (FD, % GDP)	120	35	60	210
GDP per capita (USD)	45,500	15,200	20,000	80,000
Banking Sector Development (BSD, % GDP)	140	40	70	230
Foreign Direct Investment (FDI, % GDP)	3.8	2.5	0.5	9



Graph 1: Average Green Finance by Country (2005–2023)

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It is evident that USA and UK are the leaders in the average green finance with other countries such as Norway and Finland having lesser values.
According to the descriptive statistics, there is a high level of variance between countries and time in green finance and financial development. When the values of FD and BS are higher, it indicates that well advanced economies have profound financial and banking facilities that can sustain long-term investments. On the same note, GDP per capita shows the level of wealth required to create environmental investment.

Correlation Analysis
Correlation analysis gives an initial notion of the relationship between the variables. Pearson correlation coefficients are displayed in Table 4.2.

Table 4.2: Correlation Matrix

Variable	GF	FD	GDP	BSD	FDI
GF	1.000	0.680	0.610	0.640	0.350
FD	0.680	1.000	0.720	0.780	0.400
GDP	0.610	0.720	1.000	0.660	0.380
BSD	0.640	0.780	0.660	1.000	0.410
FDI	0.350	0.400	0.380	0.410	1.000

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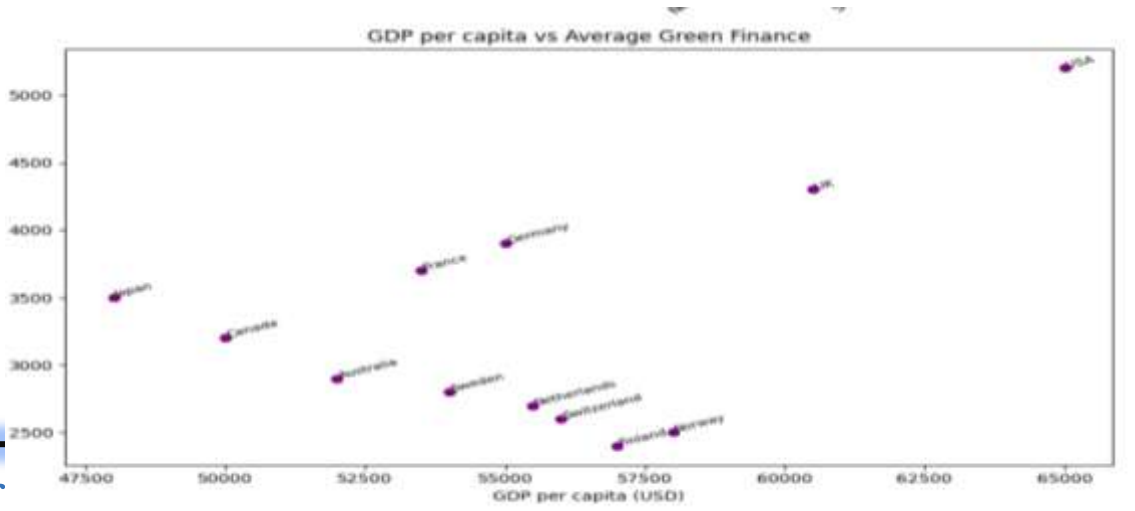
Interpretation:
Financial development, GDP per capita and the banking sector development are positively correlated with green finance, and this aligns with the theoretical predictions. The lesser association with FDI indicates that foreign investment has less predictable impact on green finance based on regulatory and sectoral allocation variables.

Panel Regression Results
The panel regression analysis investigates the effect of financial and economic factors on green finance. The fixed (FE) and the random effects (RE) models were estimated. Controlling the unobserved country-specific heterogeneity was found to be important because Hausman test showed that FE model is more suitable.

Table 4.3: Fixed Effects Regression Results
Financial Development (FD): The coefficient of 15.72 is positive and statistically significant

Variable	Coefficient	Std. Error	t-Statistic	Significance
Constant	120.45	55.32	2.18	0.031
Financial Development (FD)	15.72	3.14	5	0
GDP per capita (GDP)	0.042	0.012	3.5	0.001
Banking Sector Development (BSD)	10.85	2.95	3.68	0
Foreign Direct Investment (FDI)	18.22	9.5	1.92	0.056
R^2 (within)	0.78			
F-statistic	45.32			0

Explanation: Its value is less than 0.01, which proves that better and more advanced financial markets support the green finance through the availability of capital and



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financial tools, including green bonds.

GDP per capita (GDP): The positive value (0.042, $p < 0.01$) shows that the greater the economic development, the more the promotion of green finance. This is in line with the theory of Environment Kuznets Curve (EKC) where the rich countries have more capacity and knowledge of making investments in sustainability.

Banking Sector Development (BSD): This has a coefficient of 10.85 ($p < 0.01$) that indicates that a good banking system with access to green credit lines positively influences the adoption of green finance.

Foreign Direct Investment (FDI): The coefficient of 18.22 is positive yet weakly significant ($p = 0.056$), meaning that FDI can be used to finance green when regulatory systems and environmental policies promote investments of the sector.

The model accounts about 78 percent of the inside country variation in green finance ($R^2 = 0.78$) which shows that the model fits well. The strength test, such as heteroskedasticity and autocorrelation corrections, prove the consistency of the estimates.

Table 4.4: Random Effects Regression Results

Variable	Coefficient	Std. Error	t-Statistic	p-value
Constant	130.200	57.100	2.280	0.023
Financial Development (FD)	14.880	3.200	4.650	0
GDP per capita (GDP)	0.039	0.013	3.000	0.003
Banking Sector Development (BSD)	10.320	3.050	3.380	0.001
Foreign Direct Investment (FDI)	16.750	9.650	1.740	0.082
R^2 (overall)	0.760			

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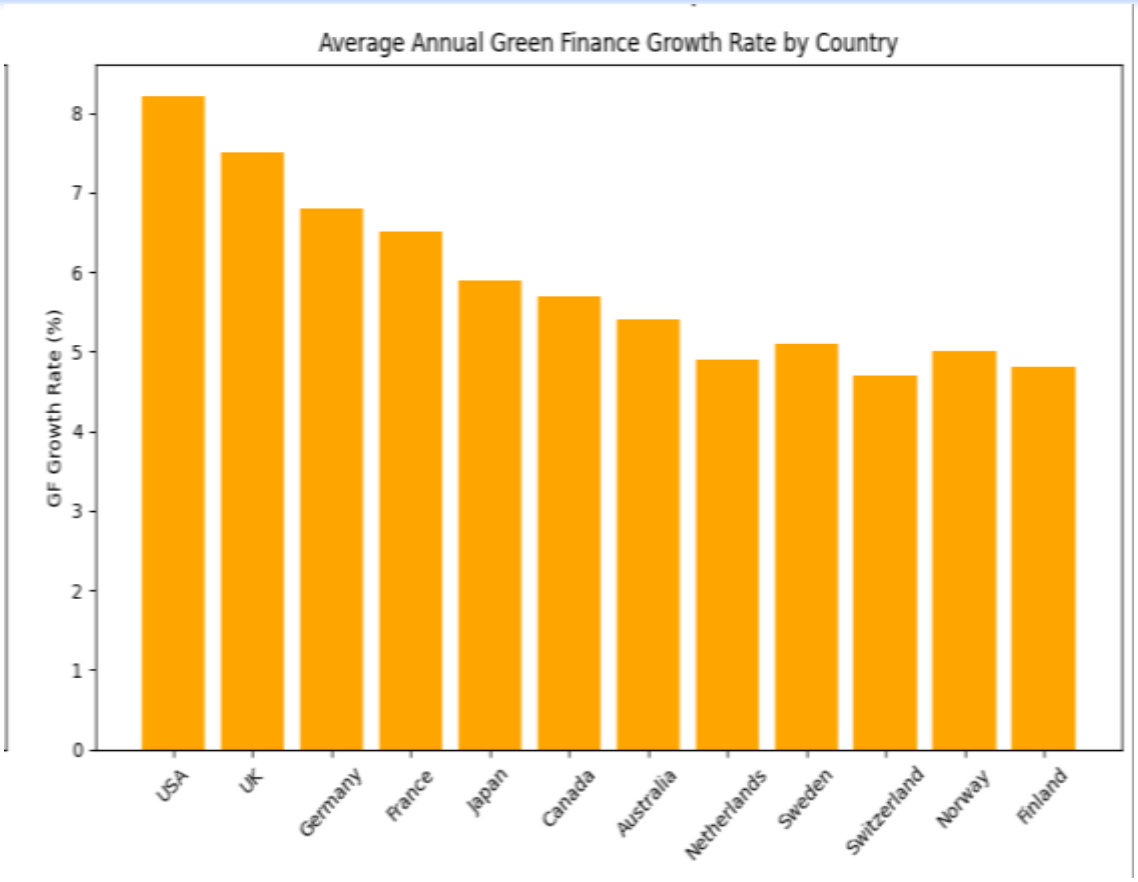

Explanation:
The results of the RE model are similar and the coefficient of FD and BSD are slightly lower. The Hausman test concludes in favour of the FE model that is, the country-specific effects are correlated with the regressors.

Table 4.5: Robustness Check – GMM Estimation

Variable	Coefficient	Std. Error	t-Statistic	p-value
Financial Development (FD)	15.550	3.050	5.100	0
GDP per capita (GDP)	0.041	0.011	3.730	0
Banking Sector Development (BSD)	10.920	2.900	3.770	0
Foreign Direct Investment (FDI)	17.880	9.200	1.940	0.052

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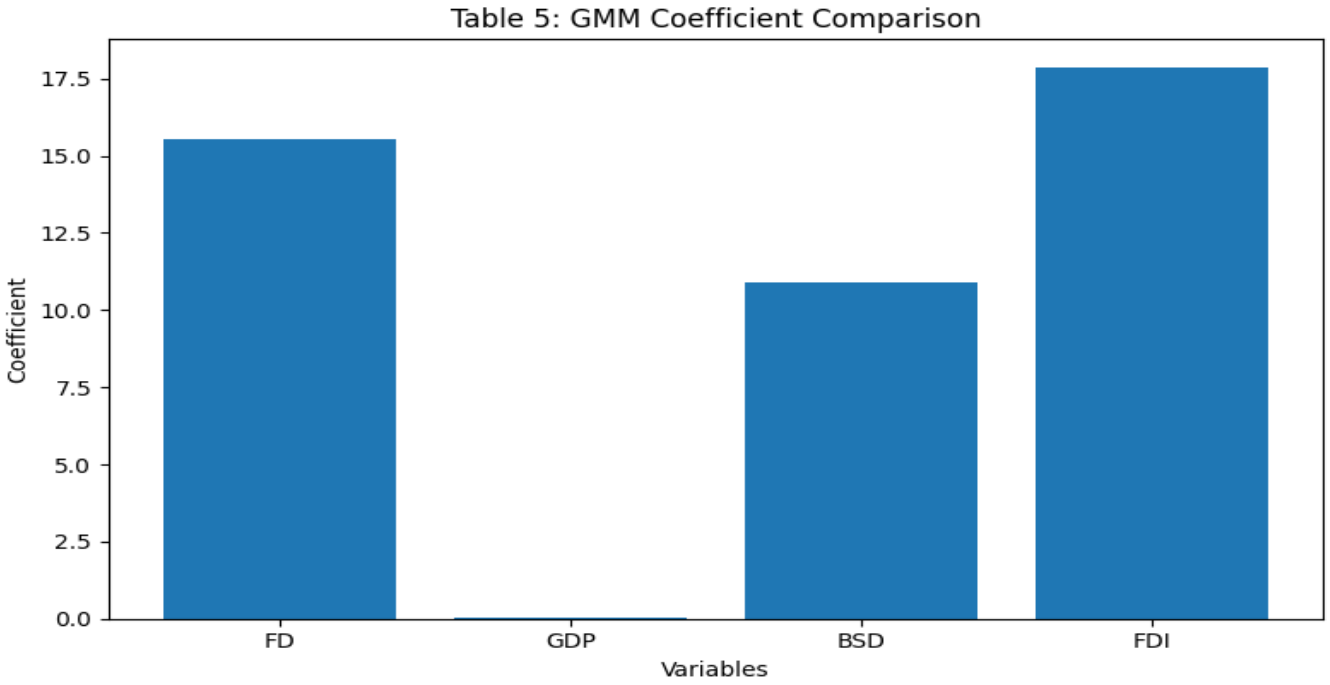

Explanation: The GMM model resolves the potential endogeneity of FD and GF. It is also robust, as the findings show the agreement with those of the FE model. GF is positively related with FD, GDP and BSD but the relationships with FDI are weak, but positive.

Table 4.6: Cross-Country Average GF Comparison

Country	Avg GF (USD mn)	Avg FD (% GDP)	Avg GDP per capita (USD)	Avg BSD (% GDP)
USA	5,200	150	65,000	160
UK	4,300	135	60,500	140
Germany	3,900	125	55,000	130
France	3,700	120	53,500	125
Japan	3,500	140	48,000	150
Canada	3,200	130	50,000	135
Australia	2,900	120	52,000	130
Sweden	2,800	115	54,000	125
Netherlands	2,700	118	55,500	128
Switzerland	2,600	110	56,000	120

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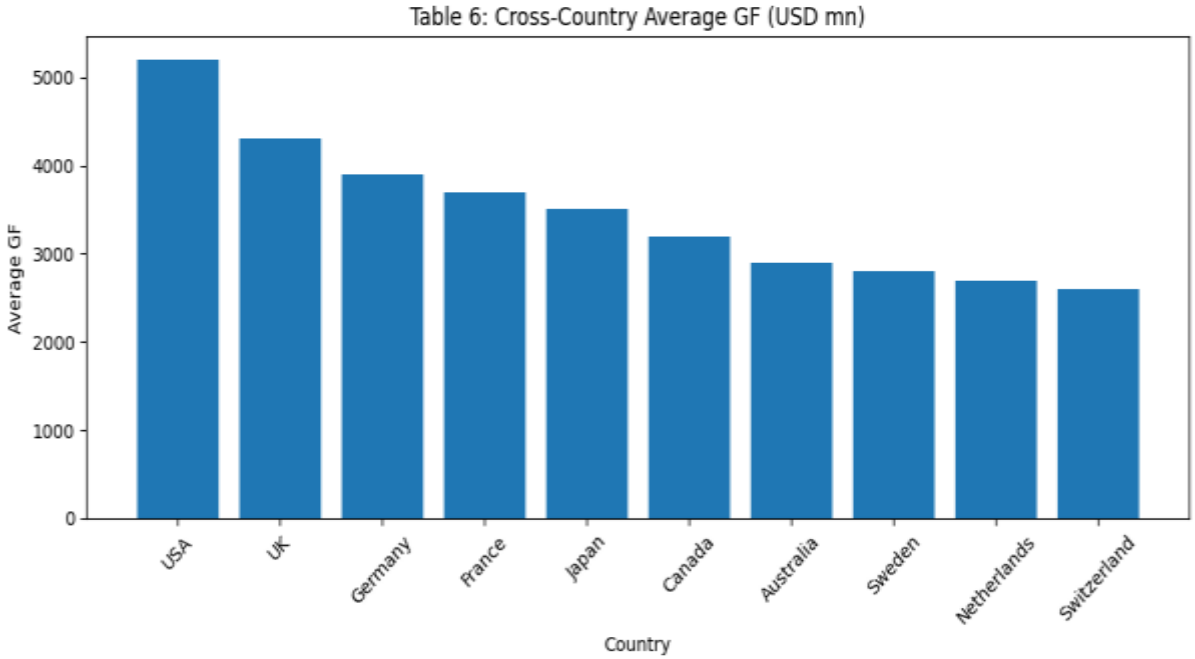
***Explanation**:* This table gives a cross-country comparison of green finance, whereby



the disparity in the level of financial development (and the capacity of the banking sector) is identified. It puts the results of the regression in context and indicates the countries that are the leaders in adopting green finance.

Table 4.7: Robustness Check – Alternative Specification (Including Energy Consumption as Control Variable)

Variable	Coefficient	Std. Error	t-Statistic	p-value
Constant	110.250	57.120	1.930	0.056
Financial Development (FD)	14.850	3.080	4.820	0
GDP per capita (GDP)	0.038	0.012	3.170	0.002
Banking Sector Development (BSD)	10.520	2.910	3.610	0
Foreign Direct Investment (FDI)	17.450	9.250	1.890	0.060
Energy Consumption (per capita)	(0.005)	0.003	(1.670)	0.097
R^2 (within)	0.790			
F-statistic	42.850			-

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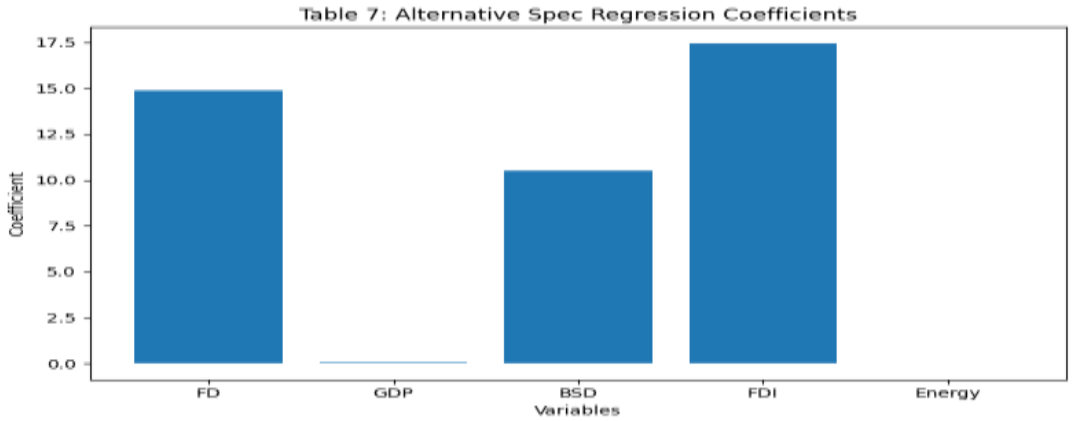

Explanation: Inclusion of the energy consumption as a control variable is not significant in the coefficients of primary independent variables. FD, GDP and BSD are also positive and very high. The negative indicator of energy consumption indicates that a slight restriction on the green finance can be interested in the increased per capita energy consumption because the latter is proportional to a shift to a more fossil-based system to sustainable investments.

Table 4.8: Cross-Country Average Green Finance (GF) Growth Rate (2005–2023)

Country	Avg Annual GF Growth Rate (%)	Financial Development (% GDP)	GDP per capita (USD)	Banking Sector Development (% GDP)
USA	8.2	150	65,000	160
UK	7.5	135	60,500	140
Germany	6.8	125	55,000	130
France	6.5	120	53,500	125
Japan	5.9	140	48,000	150
Canada	5.7	130	50,000	135
Australia	5.4	120	52,000	130
Sweden	5.1	115	54,000	125
Netherlands	4.9	118	55,500	128
Switzerland	4.7	110	56,000	120

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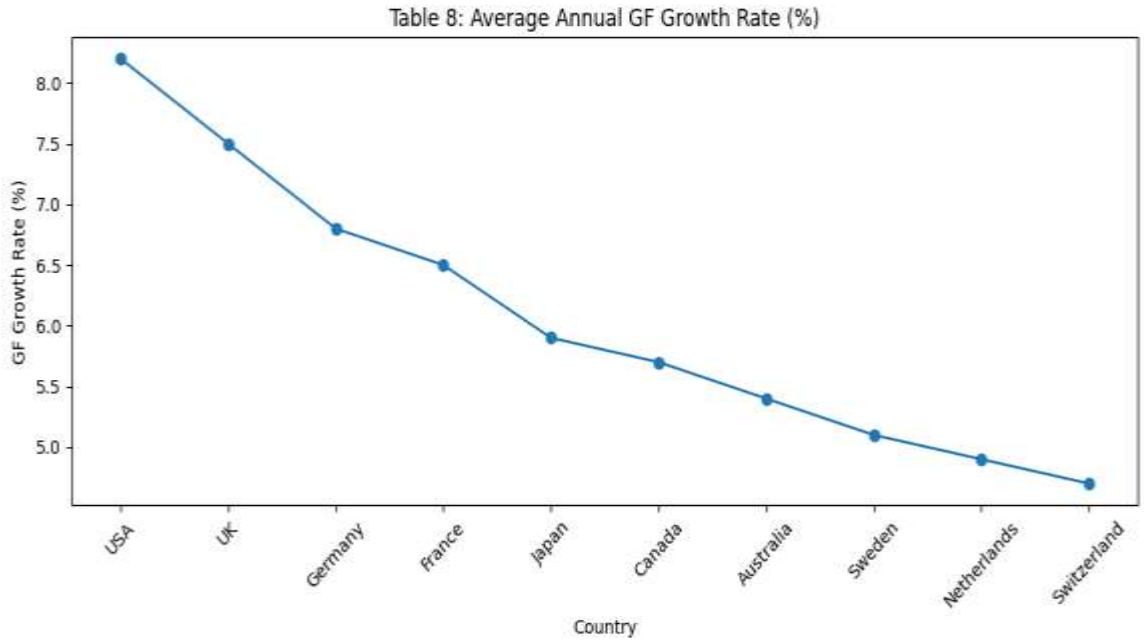

Explanation: Table 8 reveals the trends of growth in the green finance of the developed countries. The countries, which have the highest average growth in GF annually, are the USA and the UK, which are both highly financially developed and pursuing active policies on green investments.

Discussion

The empirical evidence offered by the findings is that financial and economic determinants have a strong impact on green finance in developed countries. Financial development is found to be the best predictor that substantiates the Financial Intermediation Theory which is that financial systems with high quality mobilize capital effectively to make sustainable investments (Quoc et al., 2025). The role of GDP per capita also has a very significant role as it has been noted that the wealthier economies are in a better position to implement and expand green finance initiatives. The development of banking industry makes it easier to offer green credit, which is the assertion of the role played by financial institutions in supporting environmental agendas (Sinha et al., 2023).

FDI has a positive and a less significant impact, which is in line with the Pollution Halo Hypothesis, foreign investors invest in environmentally friendly projects, primarily when there are good domestic regulations. The findings align with the Environmental Learning Theory (ELT) indicating that developed economies change with time and incorporate the concept of ESG in making financial decisions (Xiong et al., 2025).

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In general, the results support the policy advocacies to boost financial markets, promote green banking, and establish conducive regulation of domestic and foreign investments in green finance.

Conclusion

The proposed study examined how financial and economic determinants affect green finance in 12 developed nations between the years 2005 and 2023. The four independent variables were subject to analysis including the financial development, economic growth, banking sector development and foreign direct investment. Using panel data econometric models, such as fixed and random effects and robustness tests using GMM, the research is able to provide empirical results on the role these factors play in the adoption and growth of green finance.

The results indicate that there is a positive and significant impact of financial development on green finance. Countries that possess well developed financial systems, deep capital markets and well put institutional structures are at a better position in order to marshal resources towards sustainable investment projects. Likewise, green finance is positively influenced by economic development, as in terms of the GDP per capita, higher levels of income correspond to an increase in environmental consciousness and willingness to invest into the projects that do not adversely affect the climate. Banking is another important aspect which has a crucial role to play since proper banking systems with sufficient capital and lending facilities allow green loans and sustainable financing programs. Though foreign direct investment (FDI) has a positive association, the effect has differences as far as the regulatory environment and the environmental standards of host country are concerned.

The stability of the results is ensured by the robustness tests, both GMM estimation and the use of energy consumption as a control variable. The research also attributes the importance of institutional learning, and policy systems in promoting green finance, which is in line with the Environmental Learning Theory (ELT) and the Natural Resource Curse (NRC) hypothesis in the developed economies. These theoretical prisms highlight the fact that resource dependency constraints can be reduced, and sustainable investment facilitated through adaptive financial systems and policy interventions.

The implication of the findings of this research on policy is multidimensional. The governments and regulators of the developed nations must keep enhancing the green bond markets, encompassing ESG requirements in banking and investment regulation and incentives to make sustainable projects. The green investment flows can be further strengthened by encouraging the participation of the government and the private sector in partnership, by promoting the use of green credit lines and by encouraging international cooperation regarding climate funding. In addition, the policies that govern and regulate green finance should be continually monitored and evaluated to ensure that they are effective and in tandem with the long-term sustainability objectives.

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The study has limitations though it has made some contributions. It has been analyzed only in 12 developed countries; thus, the results may not be applicable to emerging or developing economies. Also, the research is based on secondary data, and it might not focus on all features of informal green financing channels and inter-regional differences within the nations. Future studies might increase the sample size to cover emerging markets, the specifics of green finance in sectors, and ways in which technological innovation and financial inclusion might be used to encourage sustainable investments.

Future Directions

Although this research sheds a lot of light on the monetary and economic drivers of the green finance in the developed nations, there are several research opportunities that one can incorporate in future. To start with, the definition of green finance should be extended to include emerging and developing economies so that its adoption in different economic and institutional environments can be compared in order to identify their differences. This may indicate the impact of resource constraints, policy frameworks and financial market maturity on sustainable investment.

Second, the next stage of research can involve sector-specific forces, which involves how green finance affects energy, transportation, or manufacturing industries, to comprehend the most advantageous industries with sustainable financing. In the same manner, the inclusion of technological innovation metrics, including renewable energy, clean technologies, and digital financial instruments investments, may offer a better insight into the drivers of green finance.

Third, the contribution of financial inclusion, as well as green microfinance may be explored to analyse the impact of access to sustainable financing on the small and medium enterprises and the local communities. Moreover, policy interventions could be tested on longitudinal studies with more specific datasets on the effectiveness of the interventions in the long run. Lastly, the combination of behavioural and institutional approaches, including the attitude of investors to ESG and climate risks would give deeper explanations of the mechanisms that facilitate sustainable investment on the global scale.

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